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RESEARCH ARTICLE

A quantitative ethnoveterinary study of traditional medicinal plants used for the management of livestock diseases in Tiruchirappalli district, Tamil Nadu, India

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Abstract

The present study aimed to document, analyze and evaluate the traditional knowledge and use of medicinal plants employed for treating livestock diseases by rural communities in the Tiruchirappalli district. Many farmers (82 %) in the Tiruchirappalli district depend on animal husbandry for their livelihood and practice ethnoveterinary medicine. Ethnoveterinary field surveys were conducted from 2023–2024 across different seasons and 280 respondents, including farmers and traditional healers were interviewed using semi-structured questionnaires across multiple villages. Data were analyzed quantitatively using informant consensus factor (ICF), relative frequency of citation (RFC) and use value (UV) indices to assess the importance and agreement of reported species. A total of 45 plant species belonging to 43 genera and 25 families were documented for managing seven categories of livestock ailments, including gastrointestinal, gynaecological, dermatological, cold and fever, respiratory, poisoning and general health disorders. The Fabaceae family was the most represented with eight species recorded in the survey. Leaves (92 %) and roots (87 %) were the most frequently used plant parts and raw plant material was the preferred method. *Piper betel* L., *Leucas aspera* (Willd.) Link, *Aerva lanata* (L.) Juss., *Cassytha filiformis* L., *Aloe vera* (Burm.) f. and *Bambusa vulgaris* Schrad ex. J. C. Wendl. recorded the highest citation and use values. The findings demonstrate a high level of consensus among informants and emphasize the relevance of traditional plant-based knowledge for sustainable livestock healthcare and future pharmacological investigations.

Keywords: ethnoveterinary medicine; indigenous practices; livestock health; medicinal plants; Tiruchirappalli district; traditional knowledge

Introduction

Livestock plays a pivotal role in the rural economy of countries like India. Ethnoveterinary practices serve as an alternative and integral component of traditional veterinary systems in rural communities and contribute to reducing economic losses caused by livestock diseases (1, 2). Local medicinal plants are widely used to manage livestock diseases and are especially valuable in areas where modern veterinary services are absent, inconsistent, or unaffordable (3). The reliance on plant-based remedies is attributed to limited access to veterinary facilities, high costs of synthetic drugs and strong cultural confidence in traditional treatment systems (4–6). In Tamil Nadu, a wide range of traditional medicinal practices continues to be actively practiced in rural and tribal communities. However, quantitative assessments of ethnoveterinary medicinal plants remain limited in the Tiruchirappalli district. Siddha healers, who are formally trained in a codified medical system, are often incorrectly categorized as folk practitioners. Folk medicine originated from early human responses to natural events and health-related challenges and later became an integral part of cultural traditions. Unlike modern medicine, folk medicine relies on orally transmitted knowledge shared across generations, similar other cultural and artistic practices. These healers, whether formally trained or rooted in folk traditions, continue to play an essential role in livestock healthcare across rural India (7, 8). Rapid socio-economic changes, declining interest among younger generations and increased reliance on modern veterinary knowledge require such an investigation. The present study bridges this research gap by quantitatively documenting and analyzing ethnoveterinary medicinal plants used for livestock healthcare, thereby contributing baseline data for knowledge conservation, sustainable utilization and future pharmacological validation.

Cattle rearing plays a vital role as a supplementary livelihood in the Tiruchirappalli district. With abundant fodder resources, the district sustains a large population of cows, bulls and goats. Local communities place considerable importance on the health and productivity of their domestic animals. In the absence of adequate modern veterinary facilities in remote villages, people continue to depend on traditional ethnomedicinal practices, preparing remedies from locally available medicinal plants. The present study seeks to document ethnoveterinary knowledge among indigenous communities in Tiruchirappalli district and to examine the socio-economic and demographic factors that may influence the retention and transmission of this knowledge.

Materials and Methods

Study area

Tiruchirappalli district, situated on the banks of the Cauvery River, is one of the major districts in Tamil Nadu. The district covers an area of approximately 4511 km^2. Geographically, it lies between 10°17′–11°25′ N latitude and 78°09′–79°03′ E longitude. It shares borders with several other districts, including Karur, Namakkal, Perambalur, Ariyalur, Pudukkottai and Thanjavur. Nearly one-twelfth of the district's area consists of revenue forests and hill regions, with the Pachamalai Hills near Thuraiyur being the most prominent (Fig. 1). The Cauvery River, the district's lifeline, flows across its length and serves as the primary source of irrigation and drinking water. It irrigates approximately 51000 hectares, supporting a net cropped area of about 141282 hectares.

Ethnoveterinary survey

This study employed semi-structured interviews using standardized questionnaires (9). The questionnaire covered socio-demographic characteristics (age, gender, occupation, education and community) and ethnoveterinary details, including local plant names, parts used, preparation methods, dosage, mode and route of application and associated ailments (10). Field surveys were conducted from February 2023 to July 2024 across 11 taluks: Tiruchirappalli West, Lalgudi, Manapparai, Musuri, Thuraiyur, Srirangam, Mannachanallur, Thottiyam, Thiruverambur, Marungapuri and Tiruchirappalli East. The questionnaire was divided into three sections (11). The first section covered socio-demographic details of the participants, the second collected ethnomedicinal data on plants and their uses and the third involved field walks for direct plant collection. To ensure reliability, the information obtained from individual interviews was cross-verified with other participants in the same villages.

Plant specimen collection and identification

Standard procedures were followed for the collection and documentation of plant materials. Information such as the local name, collection date, collection site and series number were documented. Plant specimens were dried and pressed following standard herbarium techniques. Identification was carried out at the Department of Botany, Bharathidasan University, using Flora of the Tamil Nadu Carnatic by K. M. Matthew (12) and cross-verified with online databases, including The Plant List (http://www.theplantlist.org) and World Flora Online (www.worldfloraonline.org). Specimens were further confirmed and identified at the Rapinat Herbarium, St. Joseph's College, Tiruchirappalli. The plant specimens were deposited in the Department of Botany, Bharathidasan University, Tiruchirappalli and accession numbers prefixed with BUKP were obtained (Table S1).

Data analysis was conducted in two phases. In the first phase, a summary table was prepared to present the raw data on medicinal taxa, including scientific name, family, primary indications, animal species treated, preparation methods, number of citations and other key parameters recommended for ethnopharmacological field studies (13). In the second phase, quantitative indices such as the informant consensus factor (ICF), use value (UV) and relative frequency of citation (RFC) were applied to assess the significance of the documented medicinal plants.

Quantitative data analysis

Ethnoveterinary quantitative analysis is used to measure and interpret the importance, usage and cultural significance of medicinal or useful plants among local communities. In the present study, quantitative indices such as ICF, UV and RFC were employed to assess the ethnoveterinary knowledge documented from local informants.

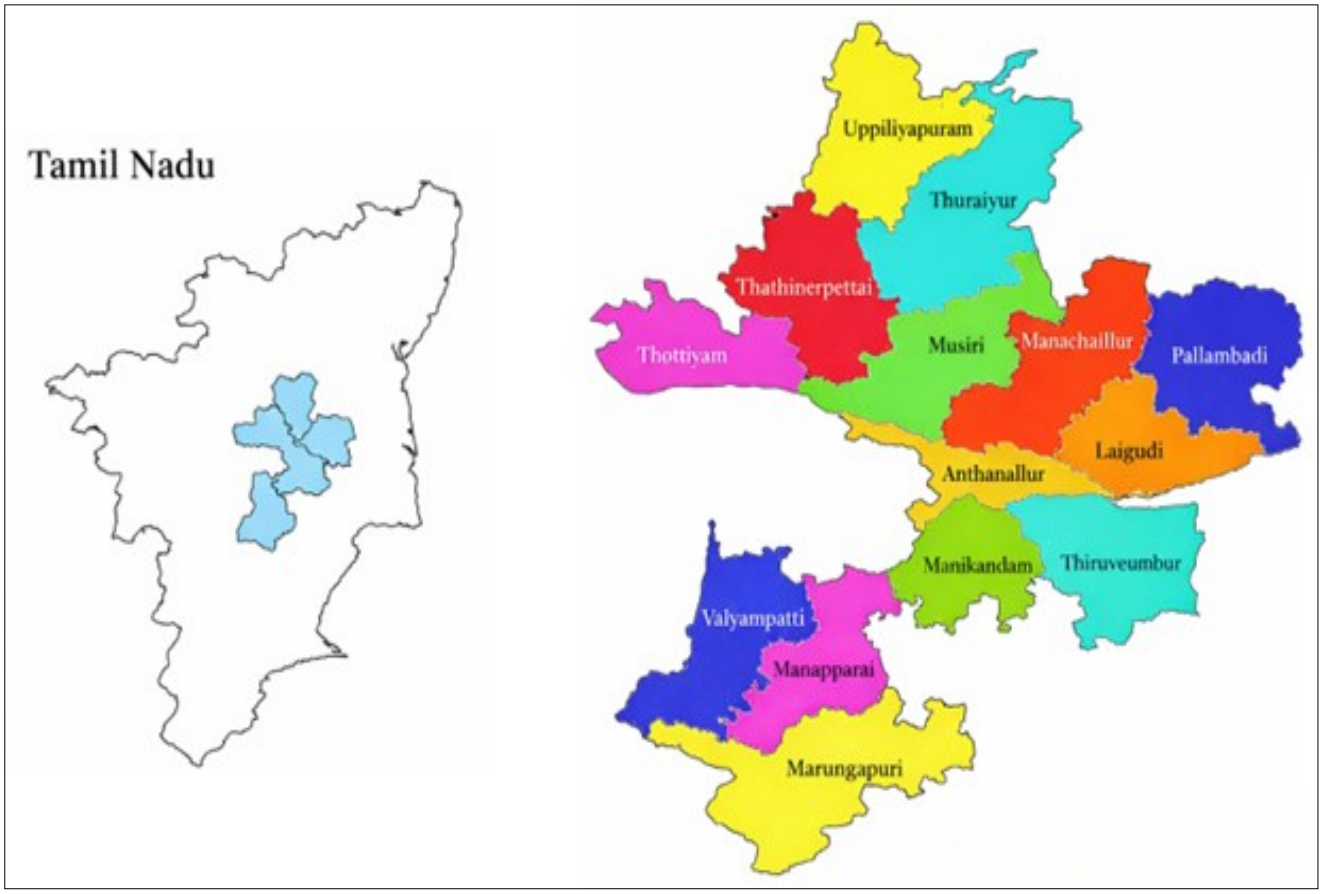

Fig. 1. Geographical distribution of the study area.

Informant consensus factor (ICF)

The reported cures for a given group of ailments were calculated using the informant consensus factor according to the following formula:

$$ICF = \frac{Nur - Nt}{Nur - 1}$$

where, Nur is the number of use reports provided by informants for a particular illness category and Nt is the number of species used for that illness by all informants (14, 15). This factor ranges from zero to one, with increasing values indicating a high rate of informant consensus.

Use value (UV)

The use value was calculated using the following formula:

$$UV = \Sigma Ui / N$$

where, Ui is the total number of use reports for a particular species and N is the total number of informants interviewed for that plant species (16).

Relative frequency of citation (RFC)

The collected ethnomedicinal information was quantitatively analyzed using the relative frequency citation, calculated as FC divided by N,

$$RFC = \frac{FC}{N}$$

where FC is the number of informants mentioning the use of a species and N is the total number of informants participating in the survey (17).

Results

Socio-demographic characteristics of informants

Out of the 280 survey respondents, 151 were men (54 %) and 129 were women (46 %). The informants were grouped into three age categories: (a) below 30 years, (b) 31–60 years and (c) 61–82 years. Most of the participants (50 %) belonged to the 31–60 age groups, followed by the 61–82 age groups (45 %), while only 5 % were below 30 years of age. The respondents' experience in traditional healing ranged from 5–35 years. Among them, 42 % had 5–10 years of experience, 36 % had less than 5 years, 16 % had 11–20 years and 6 % had more than 31 years of experience. Regarding their primary occupations, 47 % were farmers, 27 % were shepherds, 12 % were engaged in other professions and the remaining respondents were unemployed due to old age. Most of the healers had only secondary-level education (36 %), followed by 35 % who were illiterate; the remaining educational details are presented in Table 1. Approximately 80 % of the respondents stated that they had acquired their ethnoveterinary knowledge through family inheritance, while the rest had learned it from friends or mentors.

Diversity of medicinal plant species in the study area

In this study, a total of 45 medicinal plant species belonging to 25 families were documented. Fabaceae was the most dominant family (8 species), followed by Acanthaceae, Apocynaceae and Malvaceae (3 species each); Aristolochiaceae, Euphorbiaceae, Amaranthaceae, Poaceae, Cucurbitaceae, Capparaceae and Solanaceae (2 species each), while the remaining families were represented by a single species (Fig. 2). Based on growth forms, herbs were the most used (33 %), followed by trees (31 %), climbers (18 %), shrubs (16 %) and grasses (2 %) (Fig. 3). Various plant parts were utilized in remedy preparation, with leaves being the most frequently used (69 %), followed by roots (9 %); fruits and whole plants (7 % each) and stems and seeds (4 % each) (Fig. 4). Leaves were thus the preferred plant part for herbal medicine preparation.

Mode of preparation and administration

The predominant mode of preparation involved the use of raw plant material (58 %), followed by juice (20 %), paste (13 %), powder (7 %) and decoction (2 %) (Fig. 5). Among the documented taxa, 13 species were applied topically, whereas 32 were administered orally.

Ailments treated

The ethnoveterinary survey recorded a total of 45 medicinal plant species used by indigenous people to manage livestock health problems. These species were categorized into seven major ailment groups based on their reported uses (Fig. 6). The highest number of species (17 species; 35.83 %) were used to treat gastrointestinal problems, such as diarrhoea, indigestion and constipation. This was followed by gynaecological problems (12 species; 14.85 %), which included treatments for infertility and retained placenta. Dermatological ailments accounted for 8 species (19.24 %), while eye disorders (4.5 %) and poison bites (10.29 %) were each treated with 5 species. A smaller number of plants were used for cold and fever (3 species; 13.5 %) and general health conditions (2 species; 2.25 %).

Table 1. The socio-demographic characteristics of informants in the study area (N = 280)

Factors	Category	Number of informants	Percentage (%)
Age	< 30 years	14	5
	31 – 60	139	50
	61 – 82	127	45
Experience	< 5 years	101	36
	5 – 10	117	42
	11 – 20	45	16
	> 31 years	17	6
Gender	Male	151	54
	Female	129	46
Education	Primary	31	11
	Secondary	101	36
	Higher	42	15
	Degree	11	4
	Illiterate	97	35
Occupation	Agriculturalist	131	47
	Shepherd	76	27
	Other jobs	34	12
	Unemployed	39	14

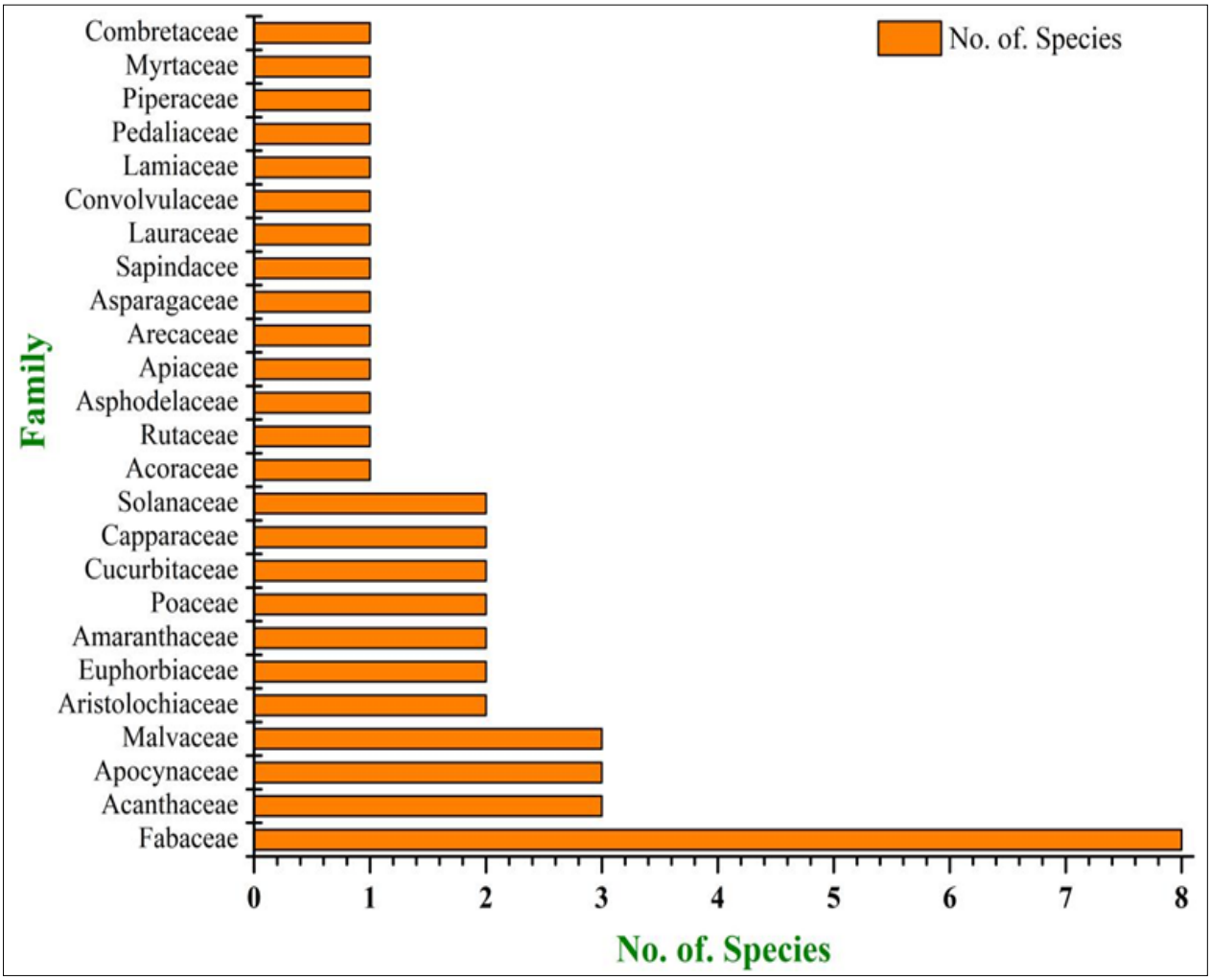

Fig. 2. Family-wise distribution of medicinal plant species used in ethnoveterinary practices in Tiruchirappalli district.

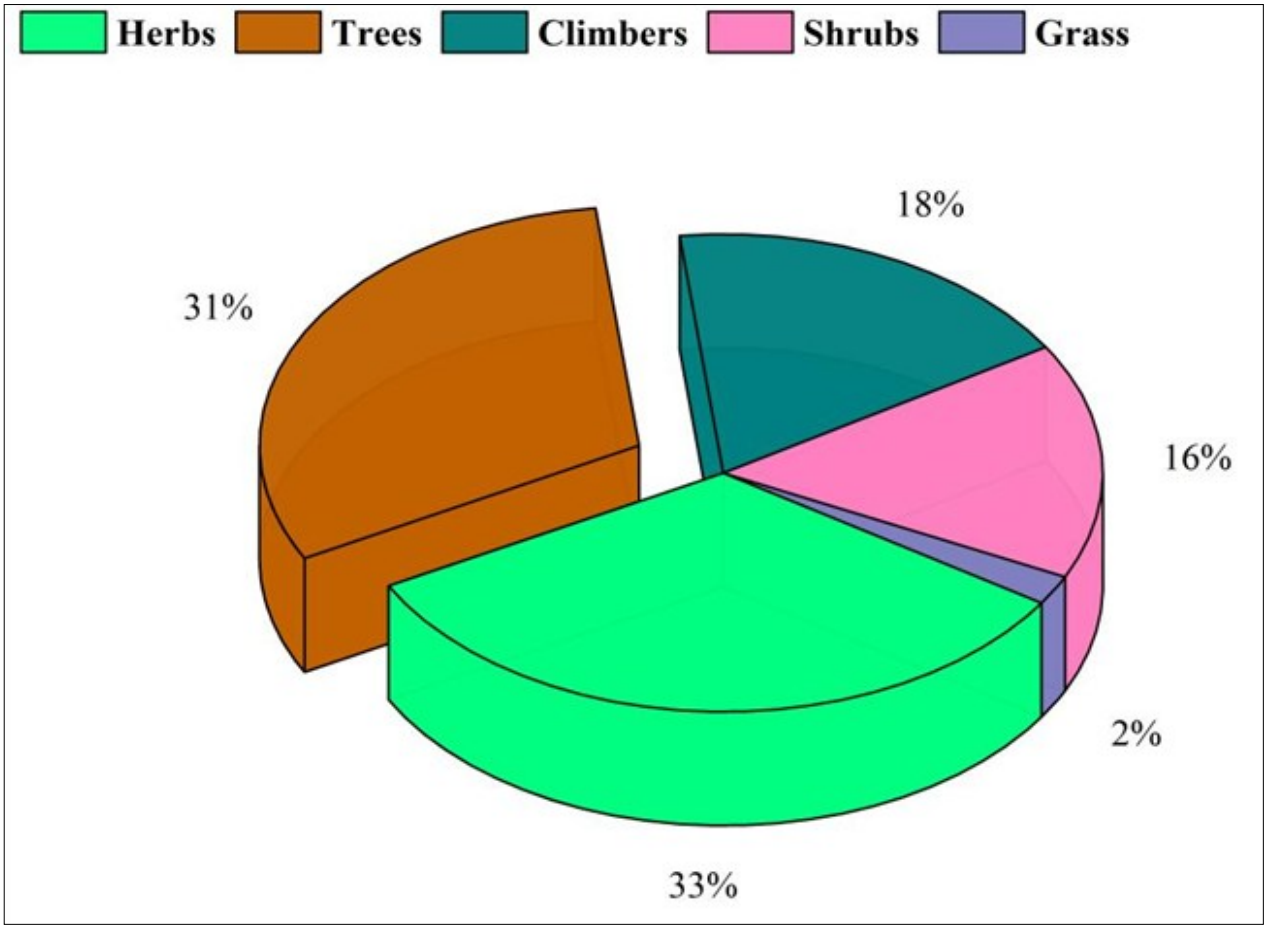

Fig. 3. Habit of medicinal plants used in ethnoveterinary practices of Tiruchirappalli district.

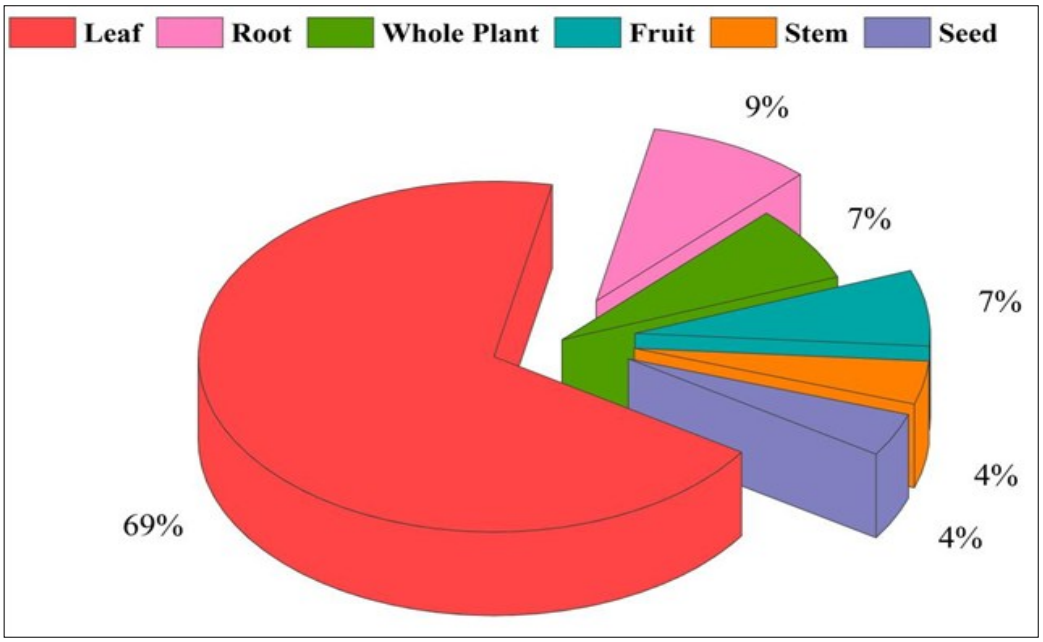

Fig. 4. Percentage distribution of plant parts used for ethnoveterinary remedy preparation.

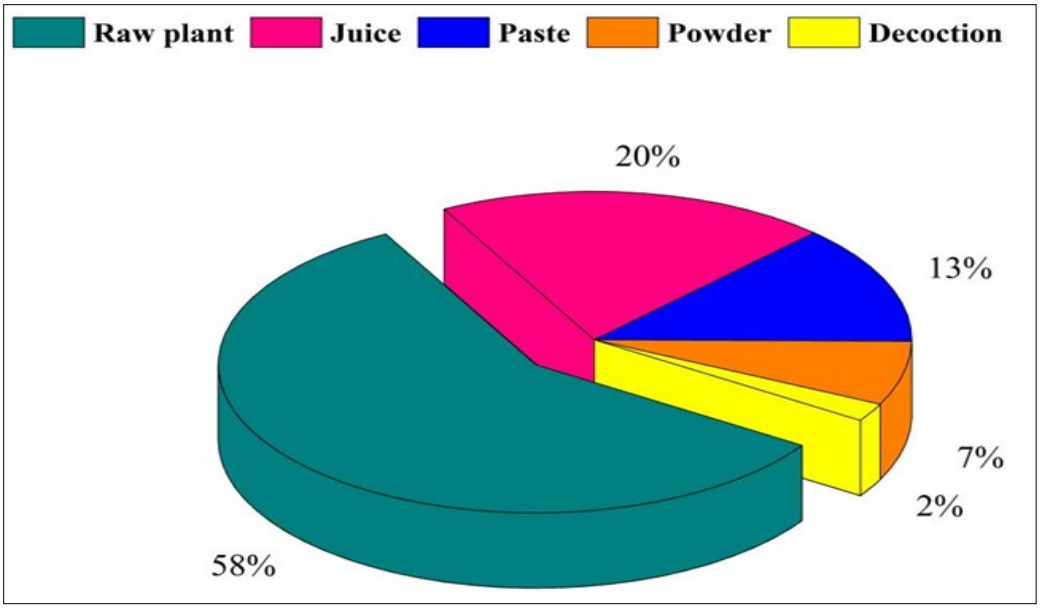

Fig. 5. Methods of preparation of ethnoveterinary remedies used for livestock treatment.

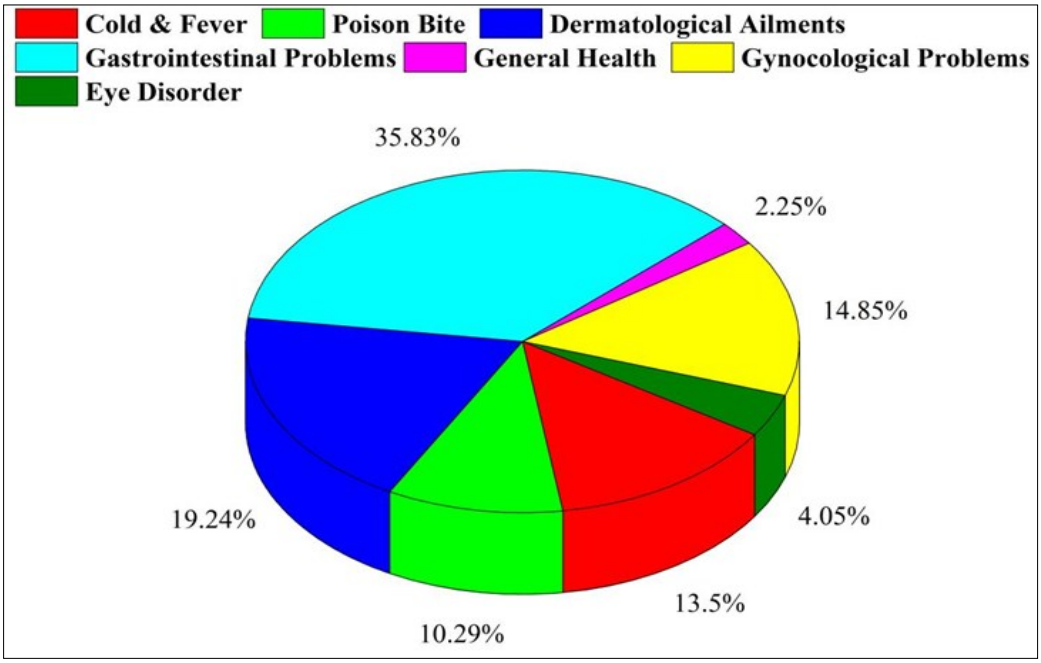

Fig. 6. Distribution of medicinal plant species across major livestock ailment categories.

Informant consensus factor (ICF)

Informant consensus factor values were greater than 0.9 for all ailment categories, indicating a very high level of agreement among informants (Table 2). The ICF value (0.99) was recorded for the cold and fever category (Nur = 240, Nt = 3), reflecting strong consensus and suggesting the existence of a few highly trusted plant species for treating these conditions. Similarly, poison bites (ICF = 0.98; Nur = 183, Nt = 5) and dermatological ailments (ICF = 0.98; Nur = 342, Nt = 8) also exhibited high consensus, indicating well-established traditional knowledge for managing these ailments using specific plants. The gastrointestinal category had the highest number of use reports (Nur = 637) with an ICF value of 0.97, highlighting both the importance of this ailment group and consistency in plant use. Gynecological problems (ICF = 0.96) also demonstrated strong agreement among informants, although with slightly greater diversity in the plant species used. An ICF value of 0.94 was observed for eye disorders (Nur = 72, Nt = 5), suggesting a relatively lower level of consensus or possibly a broader range of plant choices for treating eye-related issues.

Table 2. Informant consensus factor (ICF) values for illness categories treated by informants in Tiruchirappalli district

Ailment category	Nur	Nt	ICF
Cold and fever	240	3	0.99
Poison bite	183	5	0.98
Dermatological ailments	342	8	0.98
Gastrointestinal problems	637	17	0.97
General health	40	2	0.97
Gynecological problems	264	12	0.96
Eye disorder	72	5	0.94

Use value (UV)

The use value index was employed to determine the relative importance of each medicinal plant based on the number of use reports provided by informants. In this study, UV values ranged from 0.02 for *Ipomoea marginata* to 1.03 for *Piper betle,* reflecting notable variation in the medicinal plant used locally (Table S1). Among the recorded species, *P. betle* (UV = 1.03; 289 use report (UR)) exhibited the highest UV, followed by *Leucas aspera* (UV = 0.65; 183 UR), *Cassytha filiformis* (UV = 0.52; 145 UR), *Aerva lanata* (UV = 0.49; 136 UR) and *B. vulgaris* (UV = 0.42; 118 UR). These species displayed high UV values owing to their diverse applications in ethnoveterinary medicine, emphasizing their strong ethnobotanical significance and frequent use. In contrast, species such as *I. marginata* (UV = 0.02; 6 UR), *Senna alexandrina* (UV = 0.03), *Sida spinosa* (UV = 0.03), *Terminalia chebula* (UV = 0.03; 7 UR) and *Areca catechu* (UV = 0.04; 11 UR) showed the lowest UV values, indicates that they are less commonly used or have limited applications within the studied community.

Relative frequency of citation (RFC)

The relative frequency of citation values for the documented medicinal plant species ranged from 0.0178–0.807 (Table S1), demonstrating notable variation in the level of recognition and utilization among informants. The highest RFC value was recorded for *P. betle* (0.807; 226 FC), followed by *L. aspera* (0.578; 162 FC), *C. filiformis* (0.439; 123 FC), *B. vulgaris* (0.364; 102 FC) and *A. lanata* (0.346; 97 FC). These species were mentioned by many informants, indicating their high cultural importance and frequent use in traditional medicine. In contrast, species such as *A. catechu* and *S. alexandrina* (0.0178; 5 FC each), along with *Bauhinia racemosa* and *I. marginata* (0.0214; 6 FC each), showed the lowest RFC values, reflecting limited awareness or restricted therapeutic use among the participants. Overall, the broad range of RFC values observed highlights the diverse levels of cultural significance and medicinal familiarity of plant species within the local community.

Discussion

The ethnoveterinary knowledge documented in Tiruchirappalli district reflects long-standing plant use traditions transmitted orally across generations and shaped by local ecological conditions and resource availability. The dominance of families such as Fabaceae, Acanthaceae and Malvaceae agrees with reports from other ethnoveterinary studies in India and reflects their broad pharmacological relevance (18, 19). The predominance of Fabaceae observed in this study corroborates previous ethnobotanical and ethnoveterinary investigations, which may be due to its wide distribution (16, 18). The frequent utilization of leaves and roots recorded in the present study agrees with earlier reports, where leaves are commonly preferred owing to their availability, ease of collection and phytochemical diversity (20).

The ICF values for the major ailment categories in the present study ranged from 0.94–0.99, indicating a very high level of agreement among informants regarding the use of medicinal plants for specific health problems. Such uniformly high ICF values demonstrate that local traditional knowledge is consistent, well shared and deeply rooted within the community.

The highest consensus was observed for cold and fever (ICF = 0.99), indicating that only a few plant species were predominantly used by many informants to treat these common ailments. A similarly high ICF for fever-related diseases has been reported among rural communities in Tamil Nadu, emphasizing the cultural consistency of these plant-based treatments (18). High ICF values were also recorded for poison bites and dermatological ailments (0.98 each), signifying strong informant agreement and a concentrated use of specific taxa for these ailments. The high consensus in these categories indicates the possible presence of bioactive compounds with antimicrobial or antivenom properties, as similarly noted in studies from the Western Ghats and Ethiopia (20, 21). Gastrointestinal problems and general health conditions (ICF = 0.97 each) also exhibited strong consensus, reflecting the prevalence of digestive disorders and the effectiveness of traditional remedies, in accordance with previous reports (22). These results suggest that despite broadly shared knowledge, some individual variability exists in treatment preferences, which may depend on healer specialization. When compared to other ailment categories, the ICF value for eye disorders (0.94) was lower. This could be attributed to fewer cases, localized knowledge, or the specialized nature of eye treatments. Similar trends have been observed in other ethnomedicinal studies, where ocular treatments often display lower ICF values (23). Overall, ICF values greater than 0.9 indicate a high level of consensus among informants for most ailment categories. This study highlights a strong collective understanding of plant-based healthcare and suggests that medicinal plants cited with high consensus are culturally validated and pharmacologically promising candidates for further phytochemical and pharmacological investigations. The high ICF values observed across certain ailment categories reflect strong agreement among informants and support the effectiveness of specific plant-based remedies.

The UV index reflects the relative importance of plant species based on the number of uses reported by informants. In the present study, UV values ranged from 0.02–1.03. The highest UV was observed for *P. betle* (1.03), followed by *L. aspera* (0.65), *C. filiformis* (0.52), *A. lanata* (0.49) and *B. vulgaris* (0.42). These species are widely utilized for multiple therapeutic purposes. Plants with high UVs are generally regarded as culturally significant and pharmacologically versatile, as they tend to be employed in treating a broader range of ailments (24, 25). In contrast, species such as *I. marginata* (0.02), *S. alexandrina* (0.03), *S. spinosa* (0.03), *T. chebula* (0.03) and *A. catechu* (0.04) exhibited low UV values, indicating their limited use or restricted therapeutic applications. Low UVs may also result from species being less available or known only to specific informants (26). Overall, the variation in UV reflects both the cultural diversity of local knowledge and the availability and effectiveness of plant resources in ethnoveterinary practices. Similar patterns have been documented previously (21, 23, 27).

In this study, RFC values ranged from 0.018–0.807 (Table S1), showing notable variation in the level of recognition and usage among the surveyed community. Among the recorded species, *P. betle* (RFC = 0.807) showed the highest citation frequency, indicating that it is one of the most known and used medicinal plants in the study area. Other species with high RFC values include *L. aspera* (0.578), *C. filiformis* (0.439), *B. vulgaris* (0.364) and *A. lanata* (0.346). The high RFC of these plants reflects their strong cultural familiarity, wide therapeutic applications and accessibility to local people. Conversely, species such as *A. catechu* (0.018), *S. alexandrina* (0.018), *Bauhinia racemosa* (0.021) and *I. marginata* (0.021) exhibited the lowest RFC values, suggesting that they are rarely mentioned by informants, possibly due to limited availability, restricted medicinal use, or lower cultural prominence.

The higher RFC values observed for species such as *P. betle and L. aspera* align with previous reports from South India and other tropical regions, where these taxa are deeply embedded in ethnoveterinary practices (27, 28). The lower RFC values may reflect locally specific knowledge or declining use trends, which can serve as indicators of ethnobotanical knowledge erosion in certain communities (24). Similar correlations between RFC and UV have been reported in several recent ethnoveterinary studies, supporting the idea that frequently cited plants tend to hold significant ethnomedicinal roles (18, 21, 23). High UV and RFC recorded for species such as *P. betel* L., *L. aspera* (Willd.) Link, *A. lanata* (L.) Juss., *C. filiformis* L., *Aloe vera* (Burm.) f. and *B. vulgaris* Schrad. ex. J.C. Wendl. indicate their widespread acceptance and repeated use in traditional livestock healthcare. These species have been previously cited for the management of gastrointestinal, dermatological and febrile conditions, supporting the cultural importance of the documented knowledge (29, 30). Moreover, these plants have been reported to possess antimicrobial, anti-inflammatory, antioxidant and wound healing properties (31–33). The quantitative approach employed in this study strengthens its scientific relevance and facilitates the identification of highly cited plant species for further pharmacological evaluation.

The high-use medicinal species documented in this study have been widely reported in ethnoveterinary studies from India and other regions, emphasising the vulnerability of wild medicinal plant resources. This highlights the need for community-based conservation measures and the integration of ethnoveterinary knowledge into local biodiversity management programmes. Species with high UV and RFC values should be prioritised *for ex situ* conservation.

In this district, the close interaction between the rural population and their natural surroundings fosters an extensive dependence on indigenous plant resources for animal well-being. Limited access to modern veterinary infrastructure and the high cost of commercial pharmaceuticals further promote the use of herbal remedies. Moreover, the oral transmission of indigenous knowledge across generations, deeply intertwined with daily agricultural and pastoral activities, has sustained the prominence of ethnobotanical practices in the region. Collectively, these ecological, economic and cultural factors underpin the widespread reliance on ethnoveterinary and ethnomedicinal plant use in Tiruchirappalli district.

Conclusion

The present ethnoveterinary study conducted in Tiruchirappalli district revealed rich traditional knowledge regarding the use of medicinal plants for livestock healthcare. A diverse range of plant species was documented, demonstrating that local communities still depend largely on plant-based remedies for treating animal ailments. The quantitative ethnobotanical indices-UV, RFC and ICF-provided valuable insights into the cultural importance, informant consensus and therapeutic potential of the documented species. Together, these results validate the reliability of recorded ethnoveterinary information. Plant species exhibiting high consensus and frequent use, notably *P. betle*, *L. aspera* and *A. lanata*, represent promising candidates for future pharmacological investigations and may contribute to the development of sustainable and locally accessible livestock healthcare strategies. Overall, the findings provide baseline data that support the scientific validation of ethnoveterinary practices and contribute to the development of sustainable and cost-effective livestock healthcare strategies.

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Authors' contributions

TKP carried out the investigations and formal analysis and drafted the manuscript. MS conceived the study and reviewed and edited the manuscript. All authors read and approve the final manuscript.

Compliance with ethical standards

Conflict of interest: Authors do not have any conflict of interest to declare.

Ethical issues: None

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